A2

[0006] Inductively coupled sources are becoming widely used for processing systems used in semiconductor manufacturing. Typical ICP sources employ an antenna that couples RF energy into a working, or processing, gas in a vacuum chamber, thus exciting a plasma in the gas. Such sources further employ an electrically insulating window or other electrically insulating material barrier between the antenna and the processing zone. A window, where used, may provide a barrier between atmospheric air and the vacuum of the chamber. Early use of high frequency coils for ionization of evaporated particles of coating material is described in U.S. Patents Nos. 3,974,059 and 5,178,739.

[0007] In ICP semiconductor processing systems, the ICP source is an integral part of the vacuum chamber that contains the working or processing gas that is used for processing of the semiconductor wafers. For metal deposition and etching applications, a dielectric window or other electrically insulating structure has to be protected from plasma to avoid building-up conductive coatings on the surface of the insulating material that could prevent efficient RF power delivery into the plasma. Surface protection of the insulating material is provided by a structural device, namely, a deposition baffle placed between the plasma and the insulating material. The electrically insulating material is referred to hereafter as a window. Such a window is typically formed of a dielectric material such as ceramic. Deposition baffles made of slotted shields are described in U.S. Patent Nos. 4,431,901; 4,795,879; 4,897,579; 5,231,334; 5,234,529; 5,449,433 and 5,534,231. Their use in ionized physical vapor deposition (iPVD) systems is described in U.S. Patents Nos. 5,800,688 and 5,948,215, using cylindrical sources, and in U.S. Patent Nos. 6,080,287 and 6,287,435 using planar flat and three-dimensional antennae.

A[3]

[0012] An important property of a deposition baffle is its transparency to electromagnetic fields. Slots allow azimuthal magnetic flux, which is produced by currents flowing in the conductors of an antenna that encircle the conductors in planes normal to the conductors, to pass through the baffle. An electric field is induced across the gaps between adjacent slots of the baffle that border the slots, which is in a direction such that it supports *ExB* movement of flux from the gap and away from the antenna. The transmission coefficient may reach values up to the 0.8 – 0.9 range. An electrically conductive deposition baffle, however, can produce two adverse effects on antenna-to-plasma coupling properties: (1) magnetic shielding of the antenna current I_a, and (2) possible significant ohmic losses. Both effects are stronger when magnetic flux normal to the surface of the baffle is increased.

A[4]

[0014] The initial ionization of gas in the chamber requires a high enough voltage to cause electron and ion generation from neutral atoms. Further, to maintain the plasma, at least as many atoms have to be ionized to produce ions and electrons as are lost by collisions within the chamber space or with the chamber walls. If too many electrons are lost, the plasma collapses or is never formed. A well-designed deposition baffle shields most of the electric field from the antenna and makes it difficult to ignite a plasma by an electric field from the antenna. Increasing the RF current through the antenna to produce stronger electric fields in its vicinity can result in high voltage at the antenna that can produce an atmospheric discharge outside of the chamber, and thus unsafe operation and potential component damage. Further, the lower the pressure in the chamber, the more difficult is plasma ignition.

[0064] Inside of the window 23 is a deposition baffle 30 of electrically conductive material having, in the embodiment shown, a plurality of parallel linear slots 31 therethrough. Preferably, the baffle 30 is metal. The baffle 30, between each pair of adjacent slots 31, is in the form of an elongated slat 32. The coil 21 has a plurality of parallel conductor segments 24 that lie close to the outside of the window 23 and interconnected by return segments 25 configured so that the currents I_a in the segments 24 flow in the same direction and generate the magnetic field B_a (**Fig. 1A**) that excites a high density plasma 40 within the chamber 11. The slots 31 in the baffle 30 lie in planes that are perpendicular to the segments 24 of the coil 21. The flux lines of the magnetic field B_a lie in these planes. These flux lines loop through the slots 31 and around a volume of gas in the chamber 11 adjacent the baffle 30, thereby coupling the RF energy from the coil into the gas within the chamber 11 to sustain the plasma 40 that has been ignited in the gas. This plasma is manifested as a plasma current 41 of charged particles of processing gas that opposes the field from the coil.

A5

<u>In the Claims</u>

Replace Claims 1 and 2 with the following amended claims, and add the following new claims 21-36: